

NBS Microdensitometer  
Study File

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Progress Report

Project 2120431

From beginning of project to June 30, 1964

This project is concerned with methods and physical standards for the calibration of the length scales and photometric scales of microdensitometers.

Before a microdensitometer can be calibrated with respect to the length and uniformity of travel of the stage, it is necessary to ascertain the regularity with which the table moves with respect to the ways and the screw. The various kinds of measurements which must be made have been ascertained and a method applicable in the field has been developed for measuring these characteristics. These methods have been applied by scientists in the Engineering Metrology Section of the National Bureau of Standards to the microdensitometer in use in the Photographic Research Section. By the use of a collimator and mirror system, it was determined that the angular tilt of the table measured in the center of travel due to direction of travel was found to be 0.4 seconds in the vertical plane and 1.6 seconds in the horizontal plane. The spacing between the microscope mount and the working surface on the table was found by dial indicator not to vary by more than 0.0002 inch with the table traversed through the full range of 25 centimeters.

Resolution targets having spatial frequencies to 1,000 lines per millimeter have been produced. Further experiments are being done to improve the quality of such resolution charts.

In the past, the density scales of microdensitometers have been calibrated by means of photographic step tablets having known densities as defined in the American Standard for Diffuse Transmission Density. This kind of density is inappropriate for the calibration of microdensitometers because the geometrical conditions of illumination and sensing in such instruments differs greatly from the geometrical conditions specified in the American standard. Microdensitometers commonly employ high numerical-aperture illumination and sensing. These high numerical apertures are necessitated by the high resolution required of these instruments. In the American standard method, the sample is illuminated with a pencil of light having a very small cone angle and the light transmitted by the film is collected by an integrating sphere regardless of the angle at which it leaves the sample. A new kind of density has been defined, having geometrical conditions of illumination and sensing identical to those employed in microdensitometry. A "standard microdensitometer" has been constructed to calibrate photographic step tablets for the purpose of calibrating microdensitometers. The numerical apertures of the illuminating and sensing system are variable from 0.012 to 0.65.

Declass Review by NIMA/DOD

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